COSEWIC
Assessment and Update Status Report

on the

American Ginseng
Panax quinquefolius

in Canada

ENDANGERED
2000

COSEWIC
COMMITTEE ON THE STATUS OF
ENDANGERED WILDLIFE
IN CANADA

COSEPAC
COMITÉ SUR LA SITUATION DES
ESPÈCES EN PÉRIL
AU CANADA

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COSEWIC
Assessment Summary

Assessment Summary – May 2000

Common name
American Ginseng

Scientific name
Panax quinquefolius

Status
Endangered

Reason for designation
In spite of restrictions on international trade, high rates of collection continue and there have been significant losses of populations over the last decade.

Occurrence
Ontario and Quebec

Status history
Designated Threatened in April 1988. Status re-examined and uplisted to Endangered in April 1999. Status re-examined and confirmed Endangered in May 2000. May 2000 assessment based on new quantitative criteria applied to information from the existing 1999 status report.

COSEWIC
Executive Summary

American Ginseng
Panax quinquefolius

Description

American ginseng, also known as ginseng (*Panax quinquefolius* L.), is a long-lived perennial herb 20 to 70 cm tall. It is composed of an elongated tap-root, bearing a spindly rhizome and an aerial stem ending in a whorl of palmately-compound leaves. The inflorescence is an umbel, found at the tip of the aerial stem, that originates from the center of the compound leaves. This feature distinguishes ginseng from similar associated species.

Distribution

Ginseng occurs in the United States from New England and Minnesota south to Louisiana and Georgia. In Canada, it occurs in southwestern Quebec and southern Ontario. It is considered to be rare or uncommon in most of its North American range. In Ontario, the species shows noticeable concentrations along the Niagara Escarpment and the eastern edge of the Precambrian Shield. In Quebec, the highest concentration of populations is found in Monteregian, south of Montreal. The species' distribution range in Quebec has been reduced at its north-eastern limit.

Habitat

Ginseng requires rich, moist, undisturbed and relatively mature sugar maple-dominated deciduous woods in areas of circumneutral soil such as over limestone or marble bedrock. Colonies are often found near the bottom of gentle slopes facing south-east to south-west; a warmer microhabitat that is usually well-drained and species-rich. The forest canopy is dominated by sugar maple, white ash, bitternut hickory, and basswood.

General Biology

American ginseng is a long-lived forest perennial. Populations grow slowly and maintenance is firstly achieved through adult longevity. A plant takes several years to reach maturity. Sexual reproduction is the only reproductive means. An 18-month dormancy period is required for seed germination. Recruitment is reduced by seed

predation and high seedling mortality (70-90%). A seed has only a 0.55% chance of reaching maturity. Such a conservative life-history strategy explains the high sensitivity of ginseng to harvest. The Minimum Viable Population size for ginseng is estimated to be about 170 plants. Based on this criterion, there are only seven viable ginseng populations known in Ontario and 15 in Quebec.

Population Size and Trends

There are 139 records for ginseng in Canada, 65 in Ontario and 74 in Quebec. From 1996 to 1998, 20 previously-documented populations in Ontario were studied in detail: 25% of the 1988 sites had disappeared and 50% had declined. Harvesting was confirmed or suspected in 55% of the sites. Logging was suspected of causing declines in 25% of colonies investigated. Similar results were obtained from the 22 new sites surveyed in 1997 and 1998 (i.e. 27% extirpation). Seven viable populations are known in Ontario. The total plant count documented for the province is 8619, however, 70% were found in the two largest colonies. In Quebec, 74 ginseng occurrences are reported. Among the 59 locations surveyed since 1994, 10 populations have been extirpated (i.e. 17%) and most of the extant ones are small. Fifteen viable populations are presently known in the province, but nearly 50% of the 10,956 plants are found in two large colonies (only one is protected). In Quebec, ginseng is concentrated in the south, in the Monteregian region, the most developed and urbanized area of the province. As a consequence, most populations are small and dispersed in a fragmented landscape where habitat loss and degradation are high. Harvest has been observed in 15% of the sites sampled. Although there are 22 viable populations in Ontario and Quebec, none can be considered secure.

Limiting Factors and Threats

The main threats to ginseng are small population size, harvest, and habitat loss and degradation from clearing and logging. Small populations are highly vulnerable to environmental stochasticity, natural catastrophes and demographic stochasticity. Harvest affected 55% of surveyed sites in Ontario (nine were extirpated). Harvest severely reduces the colony reproductive potential. A 5% annual root harvest is sufficient to bring a viable ginseng population toward extirpation. Habitat loss and degradation are also a major threat for ginseng. Logging activities open the canopy and strongly modify the ecological parameters of a site (higher light intensity, lower soil moisture, introduction of invasive species, higher competition, intense grazing and higher seed predation). Logging contributed to the loss or decline of 25% of sampled sites in Ontario. In Quebec, seven populations were lost due to habitat loss and degradation. The severe ice storm in January of 1998 caused major damage to the forest canopy and may have a lasting negative impact on several ginseng colonies. Ginseng cultivation is a quickly expanding industry in Canada, the fourth ginseng producer in the world. Woodland cultivation is becoming increasingly popular, covering 1,000 to 2,000 acres in Ontario and 100 acres in Quebec. The habitat disturbances associated with site preparation and maintenance (i.e. clearing, use of fertilizers and fungicides), the introduction of seed-borne pathogens that are common in commercial

seeds, and the introduction of foreign genes by planting seeds from unknown sources, can have a significant impact on wild populations.

Existing Protection

American ginseng has been listed under Appendix II of CITES since 1973. It was designated "threatened" in 1988 by COSEWIC. Ginseng should soon be designated "espèce menacée" (i.e. the highest category under the Act) in Quebec, under the Endangered Species Act (bill 108). Export of wild roots is banned, but domestic sale and harvest are not regulated. Several populations of ginseng occur in protected areas. In Ontario, trails near at least two populations in protected areas have been relocated and one large colony threatened by a development was relocated to a protected area. Despite these measures, ginseng continues to decline. In Quebec, a conservation project for ginseng was initiated in 1994 at the Biodome of Montreal, to 1) characterize ginseng populations and their habitat; 2) develop micropropagation techniques for restoration purposes and 3) restore 10 depauperate populations. In 1997, a monitoring program was established in 10 key sites throughout the province and restoration efforts continue. Collaboration is also taking place with ginseng producers in the province.

COSEWIC MANDATE

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) determines the national status of wild species, subspecies, varieties, and nationally significant populations that are considered to be at risk in Canada. Designations are made on all native species for the following taxonomic groups: mammals, birds, reptiles, amphibians, fish, lepidopterans, molluscs, vascular plants, lichens, and mosses.

COSEWIC MEMBERSHIP

COSEWIC comprises representatives from each provincial and territorial government wildlife agency, four federal agencies (Canadian Wildlife Service, Parks Canada Agency, Department of Fisheries and Oceans, and the Federal Biosystematic Partnership), three nonjurisdictional members and the co-chairs of the species specialist groups. The committee meets to consider status reports on candidate species.

DEFINITIONS

Species	Any indigenous species, subspecies, variety, or geographically defined population of wild fauna and flora.
Extinct (X)	A species that no longer exists.
Extirpated (XT)	A species no longer existing in the wild in Canada, but occurring elsewhere.
Endangered (E)	A species facing imminent extirpation or extinction.
Threatened (T)	A species likely to become endangered if limiting factors are not reversed.
Special Concern (SC)*	A species of special concern because of characteristics that make it particularly sensitive to human activities or natural events.
Not at Risk (NAR)**	A species that has been evaluated and found to be not at risk.
Data Deficient (DD)***	A species for which there is insufficient scientific information to support status designation.

* Formerly described as "Vulnerable" from 1990 to 1999, or "Rare" prior to 1990.
** Formerly described as "Not In Any Category", or "No Designation Required."
*** Formerly described as "Indeterminate" from 1994 to 1999 or "ISIBD" (insufficient scientific information on which to base a designation) prior to 1994.

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) was created in 1977 as a result of a recommendation at the Federal-Provincial Wildlife Conference held in 1976. It arose from the need for a single, official, scientifically sound, national listing of wildlife species at risk. In 1978, COSEWIC designated its first species and produced its first list of Canadian species at risk. Species designated at meetings of the full committee are added to the list.

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Update
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in Canada

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1999

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INTRODUCTION

Ginseng was designated as threatened in 1988 due to its decline at many sites and the continued threat posed by diggers who harvest the root for sale as a medicinal plant (White, 1988). Wild ginseng has been considered rare or threatened over much of its North American range for many years (White, 1988). Concerns over its declining populations led to the plant being declared an Appendix II species in 1973 under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). Appendix II species must be monitored to ensure that continued international trade does not threaten their existence. After the CITES agreement was signed, the Quebec government decided not to issue export permits for ginseng. The Ontario government issued export permits to comply with the CITES agreement but did not establish a formal monitoring program to determine the effect of the harvest on the population (White, 1988).

The 1988 status report documented 25 extant sites (several that consisted of two or three subpopulations) of ginseng in Ontario and stated there were an additional 80 sites in the province that had been located or reconfirmed by other field botanists since 1964. Many of these 80 sites, however, may have disappeared before 1988 (White, 1988). Gagnon and Charron (1987) document 15 extant sites for Quebec and list a further 13 sites that had been located or reconfirmed after 1964. Although the average size of the populations documented in the status report is about 100 plants, most populations found consist of only one or a few plants (White, 1988). When the status report was written, the main threats to ginseng were considered to be harvest, and habitat degradation from clearing, logging, and grazing cattle (White, 1988).

Since the status report was written, a considerable amount of information has been generated on different aspects of the biology of ginseng (Charron, 1989; Charron and Gagnon, 1991; Nantel, *et al.*, 1996). Extensive field studies have been undertaken in Quebec from 1994 to 1998 (Nault, *et al.*, 1997) and in Ontario in 1997 (Nault, *et al.*, 1998). The cultivation of ginseng has also expanded tremendously (Clark and Kort, 1996). This report evaluates the status of the species in regards to the new information available and to the changes observed.

DISTRIBUTION

Ginseng occurs in the United States from New England and Minnesota south to Louisiana and Georgia. In Canada, it occurs in southwestern Quebec and southern Ontario. It is considered to be rare or uncommon in most of its North American range (Nault, 1997). Since 1988, 11 known populations were lost in Ontario (Tables 1, 2), and 35 new populations are reported based on site information recorded in the confidential Appendix 1 [22 new sites inventoried in Ontario (as listed in Table 2) and 13 additional sites recorded with collection dates in Appendix 1 that may still be extant]. The geographic range within Ontario (Figure 1), however, is essentially unchanged from that shown in the status report. A significant sampling effort has been undertaken in Quebec since 1994 (Nault, *et al.*, 1997). Of the 59 ginseng locations studied in Quebec, ten populations have been extirpated (Table 3). The loss of two peripheral populations reduces the species distribution range by more than 100 km at its north-eastern limit (Figure 2).

Table 1. Ontario sites known in 1987 and revisited 1996 – 1998

Site	Total Plants in 1987	Total Plants in 1997	Protection/ Land Ownership	Observations
	3203	3606	Private	Increase due to a larger count area in 1997. Colony affected by disease. Very low seed production. Atypical habitat and the even spatial distribution of plants suggest the site was planted.
	A=97 B=52	A=99 B=20	Conservation Authority	A: Undisturbed B: Probably harvested. Next to a hiking trail that was subsequently relocated.
	479	2389	Provincial Park	Major harvest in 1997 (50% of mature plants). Plants left are mainly young and non-reproductive.
	11	3	Private	Selective cutting and understorey removal is the likely cause of the decline.
	170	51	Private	Extensively logged about five years ago.
	A=326 B=41 C=13	0	Private	Probably harvested.
	209	126	Private	Colony declining due to harvest or deteriorating site conditions.
	89	60	Private	Partially harvested about 1990. Thinning and understorey removal may cause further decline.
	123	0	Provincial Park	Probably harvested.
	27	56	Provincial Nature Reserve	Undisturbed.
	48	569 in 1997, ≈65 in 1998	Provincial Park	Harvested in 1997, colony very visible. Severe canopy damage from the ice storm of 1998 may cause further declines.
	16	13	Provincial Park	Probably harvested, colony very visible.
	393	192	Private	Loss of canopy due to beaver activity may have caused the colony to decline.
	111	237	Provincial Park	The colony is recovering well after harvest between 1980 and 1987. Moderate canopy damage from the 1998 ice storm.
	9	1	Private	Probably harvested, development and trails nearby.
	19	0	Private	May have been harvested or declined due to beaver activity nearby.
	32	1	Private	May have been harvested or declined due to habitat degradation.
	10	0	Private	Harvested or declined due to extensive logging several years ago.
	11	4	Private	Harvested in the mid-1990s.
	63	0	Private	Harvested or declined due to extensive logging in the past two years.

Table 2. New Ontario sites first inventoried in 1997 and 1998

Site	Date Last Seen	Number of Plants	1997/1998 Count	Protection/ Land Ownership	Observations
	1993	> 100	240	Private	Colony occurring in a steep-sided ravine protecting plants from cattle grazing in adjacent areas.
	1988	Unknown	15	Provincial Park	A few isolated plants close to a trail.
	1988	15	0	Crown	Recent logging and road construction may have cause extirpation.
	1988	5	2	Crown	Probably harvested.
	1985	> 25	0	Private	Probably harvested, next to a well-used portage.
	1990	4	9	Crown	Increase due to a more careful search in 1997.
	1975	Unknown	0	Private	Probably harvested.
	1975	Unknown	0	Private	Logging probably eliminated the colony.
	1980	Several dozen	37	Private	Logging eliminated much of the population shortly before 1980.
	1996	About 35	226	Private	Increase is due to more careful searching in 1997.
	1988	A=11 B=13	A=5 B=9	Crown	Probably harvested.
	1988	Unknown	122	Crown	Most mature plants harvested in 1997.
	1995	7	20	Private	Selective logging observed.
	1997	Unknown	58	Private	New road built recently nearby.
	1991	Unknown	A=5 B=0	Crown	Recent heavy logging probably eliminated B and may cause A to decline.
	1988	17	51	Private	Good seed production but no recruitment.
	1990	About 12	30	Private	Colony occurs in an operating sugar bush.
	?	Several plants	0	Provincial Park	Colony disappeared due to harvesting or deer browsing.
	1975	25	5	Private	Extensively logged in 1996. The remaining plants will disappear due to loss of canopy.
	1992	Hundreds	575	Private	At least 105 mature plants and fruit were harvested in 1997.
	1989	9	0	Conservation Area	Colony probably disappeared due to harvesting.
	1987	Rare	25	Provincial Park	Good seed production but no recruitment.

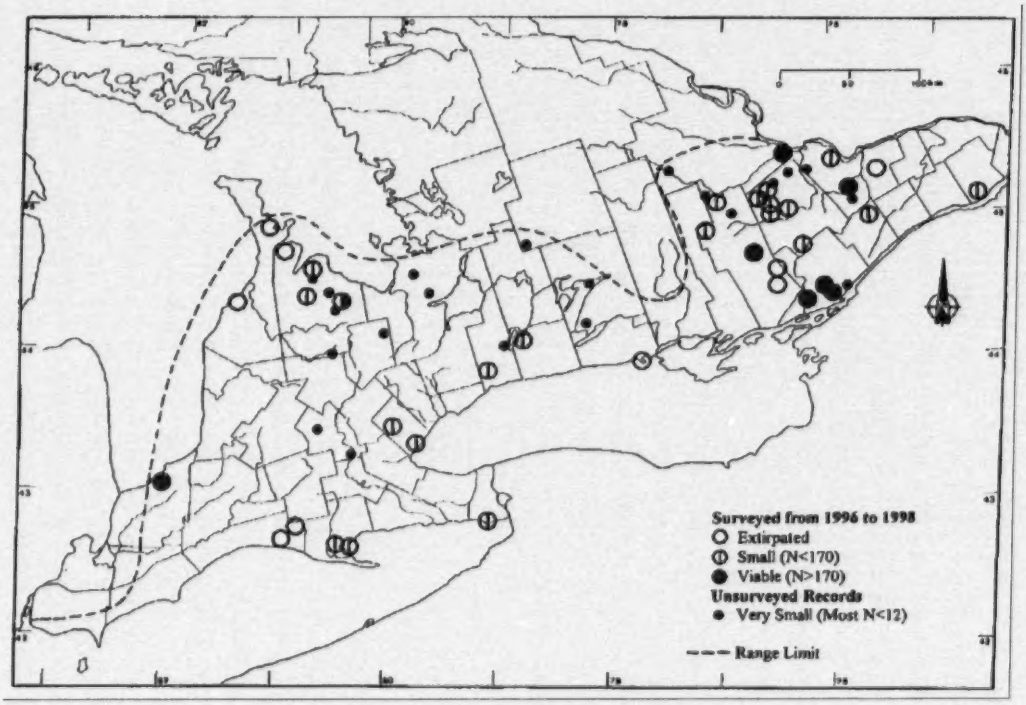

Figure 1. Ginseng populations in Ontario.

Table 3. Ginseng populations extirpated in Quebec

County	Site	Last Observation	Threatening factors observed
Gatineau	Escarpement d'Eardley	1990	Harvest?
Gatineau	Lac Forcier	1975	Habitat loss or degradation. Selective logging observed.
Pontiac	Quyon	1987	Harvest.
Deux-Montagnes	Lachute	1989	Habitat loss. Construction of a cottage.
Montreal	Sainte-Anne-de-Bellevue	1985	Habitat degradation or harvest? Suburban area.
Montreal	île Bizard	1990	Habitat loss. Nature trails enlargements.
Vaudreuil	île Perrot	1976	Habitat degradation. Pesticides used along nearby hydro-electric lines.
Rouville	Mt Rougemont	1965	Harvest?
Compton	Cookshire	1976	Habitat degradation. Forest understorey cleared for operating sugar bush.
Montmorency	Cap-Tourmente	1944	Habitat degradation? Peripheral site.

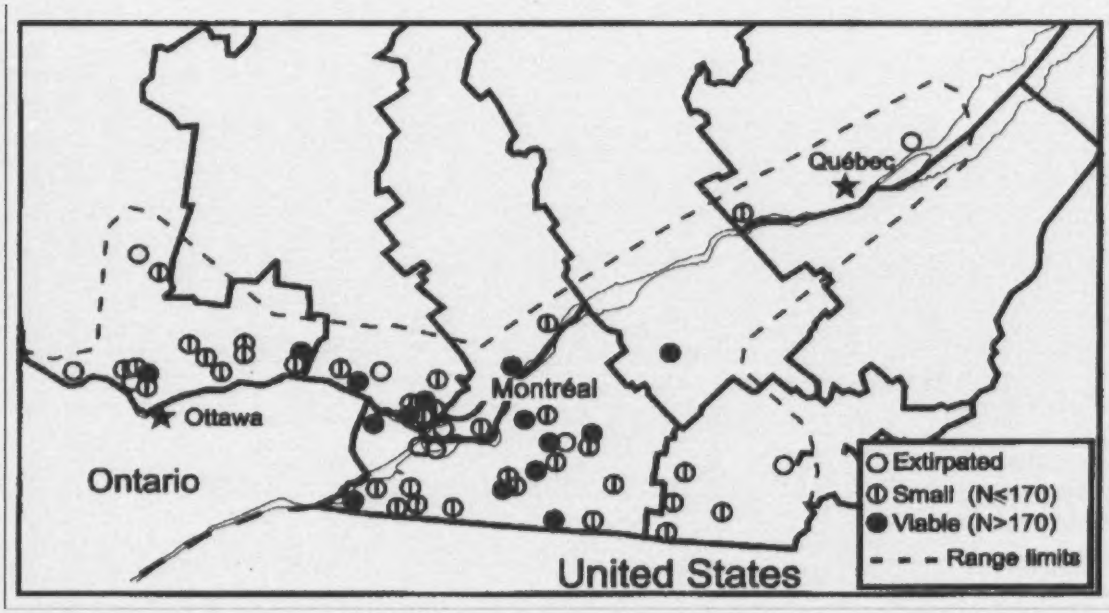

Figure 2. Ginseng populations surveyed in Quebec from 1994 to 1998 (N=59). Historical records were discarded from field surveys when insufficient information was provided or suitable habitat was lost (see Appendix 2).

HABITAT

Ginseng requires rich, moist, undisturbed and relatively mature sugar maple-dominated deciduous woods in areas of circumneutral soil such as over limestone or marble bedrock (White, 1988). Colonies are often found near the bottom of gentle slopes facing south-east to south-west. This microhabitat is warm, usually well-drained and particularly diverse in species. Ginseng habitat is at continued risk from logging and clearing. In addition, the increasing popularity of woods-cultivation brings additional pressure on potential habitat throughout the species range in Canada. Potential habitat is presently severely restricted in southern Quebec, where development (industrial, housing or recreational) and selective logging are quickly taking place. In eastern Ontario and Quebec, damage to the forest canopy from the ice-storm in January 1998 may have a lasting negative impact on some colonies. Only 20-25% of forest canopy is left in the most severely affected areas in Quebec. As a consequence, woodlot owners are actively clearing their forest to facilitate understorey regrowth. The Monteregian area, south of Montreal, was severely affected by this ice storm and the third largest colony in Quebec (nearly 1000 plants) lost two-thirds of its plants in 1998.

GENERAL BIOLOGY

The life history strategy of American ginseng is typical of a long-lived forest perennial. Populations grow slowly, remains close to the equilibrium (i.e. growth index (λ) remain

close to "1.00"; Charron, 1989). Population maintenance is firstly achieved through adult longevity (Charron and Gagnon, 1991). An individual takes several years to reach seed-producing stage (the only method of reproduction). Since seed production is closely linked to plant size, large three- and four-leaved plants produce most of the seeds in a colony. Seed predation by small rodents is often severe, significantly reducing recruitment potential in the wild (pers. observ.). Seedling mortality is high, reaching 70-90% in northern populations (Charron et Gagnon, 1991). According to Lewis and Zenger (1982) who studied ginseng in Missouri, a seed has only a 0.55% chance of reaching maturity. Such a conservative life history strategy explains the high sensitivity of ginseng to harvest.

Recent studies of ginseng populations in Quebec have demonstrated that colonies below a certain size threshold (minimum viable population size or MVP) are likely to become extirpated (probability exceeds 5% over 100 years) in the long term (Nantel, *et al.*, 1996). The MVP for ginseng is estimated to be about 170 plants (Nantel, *et al.*, 1996). Based on this criterion, there are only seven viable populations known in Ontario and 15 in Quebec.

POPULATION SIZE AND TRENDS

When the status report was written in 1988, 25 extant sites of ginseng from Ontario and 15 from Quebec had been studied in detail (White, 1988). Although the average size of colonies documented in the status report is over 100 plants, only the largest known colonies were selected for study. The average Ontario colony was estimated to be 10 to 20 plants and many sites contained only a few plants (White, 1988). An additional 80 locations from Ontario and 13 sites in Quebec could theoretically still be extant (White, 1988).

In this report, we are reporting 65 ginseng records for Ontario: 31 are known to be extant; 11 are known to be extirpated; and 23 are possibly extant. Among those, 42 sites were studied in detail between 1996 and 1998. In 1997, 20 of the 25 previously-documented populations in Ontario were re-surveyed (Table 1). The results of these revisits are alarming: 25% of the 1988 sites had disappeared and 50% had declined. Harvesting was confirmed or suspected in 55% of the sites visited. Logging was suspected of causing declines in 25% of colonies investigated. In 1997 and 1998, an additional 22 sites were searched and counted in Ontario (Table 2). Of the 22 new sites surveyed, 27% had disappeared. Few of these new sites had a sufficiently reliable previous count to determine whether the population had increased or declined. If we evaluate the 42 locations surveyed in Ontario, the situation appears very precarious (Figure 2). Eighty-three percent of previously-documented Ontario populations have been extirpated or are threatened due to their small size (i.e. N< 170 plants, the Minimum Viable Population size for ginseng; Nantel *et al.*, 1996; refer to Biology section). This figure should be seen as a conservative estimate, since only the larger sites were selected for this survey. The total plant counts documented for the province is 8619 plants, however, 70% of them were found in the two largest colonies.

The situation is also precarious in Quebec. The 1988 status report listed 15 extant sites and 13 possibly-extant sites for ginseng in Quebec. After much concentrated field effort over several seasons, the data bank of the "Centre de données du patrimoine écologique du Québec" reports 74 occurrences for ginseng. From 1994 to 1998, 59 ginseng locations were studied in detail. Ten populations have been extirpated (i.e. 17%), and most of the extant ones are small (Figure 4). In Quebec, 75% of all ginseng populations recorded have been extirpated or are threatened (i.e. N<MVP). Fifteen viable populations are presently known, but nearly 50% of all plants known in the province (N=10,956) are found in only two large colonies (only one is protected). In Quebec, ginseng is concentrated in the south, in the Monteregian region, the most developed and urbanized area of the province. As a consequence, most populations are small and dispersed in a fragmented landscape where habitat loss and degradation is high. Harvest is less common in Quebec, observed in 15% of the sites sampled.

We have documented seven viable populations of ginseng in Ontario, and 15 in Quebec. Although these stations are considered viable on a biological point of view, none can be considered secure or protected (Table 4). All face an uncertain future. Threats from harvest in Ontario and from habitat loss in Quebec are all clearly illustrated by these recent observations. Clearly, since the 1988 status report, harvest and habitat loss and degradation through logging and development have significantly reduced the ginseng population in Canada.

Table 4. Threats to viable ginseng populations in Canada

Prov.	Site	Land Ownership/Usage	Size	Characteristics	Threats (potential)
ONT		Private/ Recreation	> 500	Loss of vigor, probably due to observed disease. Very low seed production. Within town limit. Probably planted.	Disease Development (Harvest)
ONT		Private/ Pasture	240	Colony occurs in a steep-sided ravine protecting plants from cattle grazing in adjacent areas.	Cattle Grazing Isolated habitat (Logging)
ONT		Provincial Park/ Recreation	> 500	Immature colony with 2000 one-leaf plants. Half the mature plants were harvested in 1997. Very low reproductive potential.	Harvest in 1997. Highly visible from trail.
ONT		Private/ Recreation	226	Mature colony with good seed production but very low recruitment.	Logging (Gravel pit)
ONT		Private/ Unknown	192	Major decline since 1988 due to canopy opening from beaver activity. Island of deciduous forest in a large wetland complex.	Habitat degradation Isolated habitat

Table 4. (Continued)

Prov.	Site	Land Ownership/Usage	Size	Characteristics	Threats (potential)
ONT		Provincial Park/ Recreation	237	Immature population structure due to harvest. Half plants are seedlings.	Harvest in the 80s. Canopy affected by ice storm.
ONT		Private/ Unknown	> 500	Mature colony, very vigourous despite a major harvest (at least 105 mature plants and fruits).	Harvest in 1997.
QUE	001*QC [1]	Wildlife National res./ Recreation Conservation	467	Mature and moderately productive colony, but plants are small. Proportion of immature has increased from 1994 to 1998.	Trail newly established nearby. (Harvest)
QUE	003*QC	Provincial Park/ Recreation Conservation	>500	Several sub-populations dispersed in a protected area. A small colony was destroyed by disease in 1995. Harvested since 1995. Numerous trails expose this population to harvest.	Harvested since 1995. Disease
QUE	004*QC	Private/ Sugar bush Recreation	366	Major losses in 1998 from ice-storm. Sharp decline since 1995 due to the establishment of a golf course nearby. Seed production reduced.	Development Major canopy loss from ice storm. Habitat fragmentation.
QUE	006*QC	Private/ Forestry Recreation	> 500	Mature colony, very vigorous. Major damages from ice storm. Next to an ATV trail.	Logging in 1995. Major canopy loss from ice storm.
QUE	0015*QC	Private/ Sugar bush	262	Young population structure, but good regeneration. Numerous trails nearby for sap collection.	(Logging) (Harvest)
QUE	0020b*QC	Private/ Forestry	480	A few sub-populations within mature habitat. Housing project projected.	Logging Development
QUE	0037*QC	Private/ Forestry Recreation	300	A few mature sub-populations dispersed in mature forest. Numerous ATV trails. Deer grazing.	Logging Canopy affected by ice storm. (Harvest)
QUE	0051*QC	Private/ Hunting club	320	Mature population but poor recruitment.	(Logging)

[1]Locations are kept confidential. Site numbers correspond to EOCODE.

Table 4. (Continued)

Prov.	Site	Land Ownership/Usage	Size	Characteristics	Threats (potential)
QUE	0052*QC	Provincial Park/ Recreation	272	Mature colony with good seed production. Poor recruitment due to low seed viability.	(Harvest)
QUE	0055*QC	Private/ Forestry	220	Mature colony with good seed production. Poor recruitment due to major seed predation. Nearby trail.	(Logging) (Harvest)
QUE	0058*QC	Private/ Recreation Conservation	195	Immature colony with poor seed production. May have been harvested in the past. Numerous trails. Species rich habitat.	Seed harvest reported. (Logging)
QUE	0059*QC	Private/ Forestry	281	Mature colony with good recruitment reduced half size by selective logging.	Logging in 1997.
QUE	0062*QC	National Park/ Recreation Conservation	222	Immature colony growing nearby trail. Few reproductive plants. Highly visible.	Major damage from ice storm. (Harvest)
QUE	0063*QC	Private/ Forestry	248	Immature population originating from seed plantation. Established nearby trails.	Harvest Major damage from ice storm.
QUE	0068*QC	Private/ Nature trails Sugar bush	486	Mature colony, good recruitment. Mature maple forest highly fragmented by trails for sap collection and nature trails. Over 100 large plants dug in 1995. Highly visible.	Harvest in 1995. Fragmentation

LIMITING FACTORS AND THREATS

The main threats to ginseng are small population size, harvest, and habitat loss and degradation from clearing and logging. Most known ginseng colonies are small in Canada (Figures 3 and 4). Small populations are highly vulnerable to environmental stochasticity, natural catastrophes and to a lesser extent, demographic stochasticity (Menges, 1992). Most small populations revisited in Ontario in 1997, were declining (Nault, *et al.*, 1998). Harvest is a very common practice in Canada, especially in Ontario, where it affected 55% of surveyed sites. Nine populations were apparently lost due to harvest. The conservative life history strategy of ginseng explains its high sensitivity to harvest. Diggers collecting the largest plants found, remove the part of the colony that ensure population maintenance. It severely reduces the colony reproductive potential. Sutter (1982) estimated that a collected population is producing the equivalent of 12-25% of seeds produced in a non-harvested population. According to Nantel *et al.* (1996), a 5% annual root harvest is sufficient to bring a viable ginseng population toward extirpation.

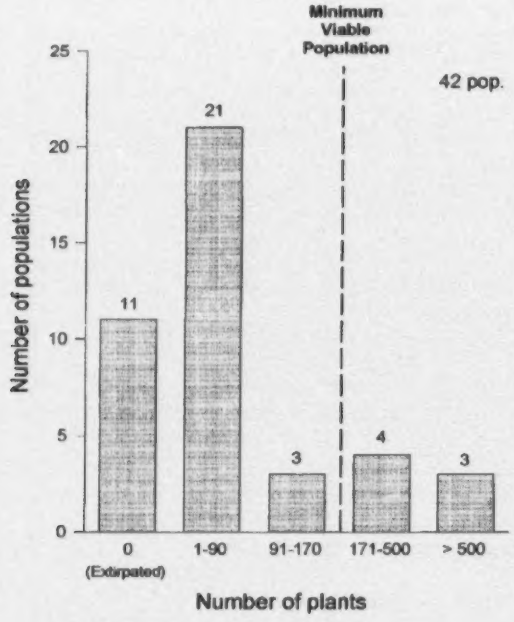

Figure 3. Sizes of American ginseng populations surveyed from 1996 to 1998 in Ontario.

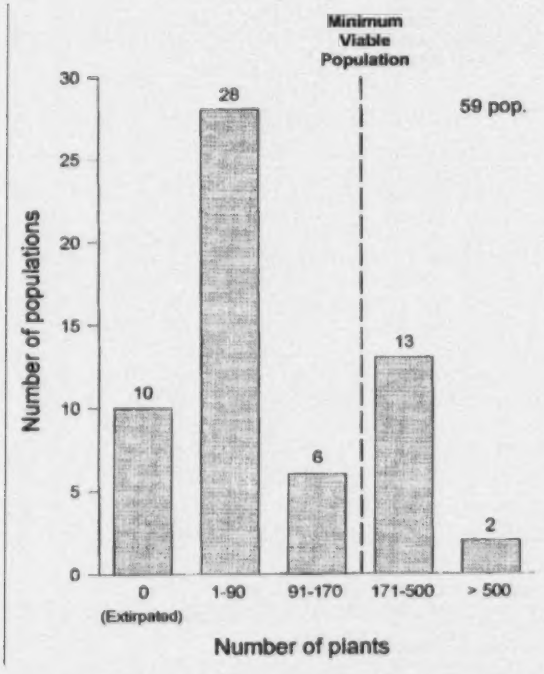

Figure 4. Sizes of American ginseng populations surveyed from 1994 to 1998 in Quebec.

Historically, diggers in Ontario seemed to have a responsible approach, harvesting roots late in the season, replanting seeds found on collected plants, and leaving some mature plants to enhance recruitment (White, 1988). The major increase in harvesting rates, however, suggests that attitudes have changed. In North Carolina, diggers harvest everything they find before another digger can come and take the rest (Sutter, 1982). Since the ban on exporting wild ginseng root from Ontario, there is no source of information concerning the amount of wild root harvested every year. It was estimated that an average of 330,000 ginseng roots per year (i.e. 248 pounds of dry roots) were harvested in Ontario between 1983 and 1986 (White 1988). The impact of stopping wild ginseng export in Canada on harvest rates is unknown. Although domestic sale is taking place, there is no estimate of sales volume currently available. Therefore, the impact of domestic sales on wild populations cannot be evaluated. Wild ginseng is widely available in the Asian natural food stores of Toronto (Wilkins, 1998).

Habitat loss and degradation is also a major threat for ginseng. Logging contributed to the loss or decline of 25% of sampled sites in Ontario. In Quebec, habitat loss and degradation seem responsible for the extirpation of seven populations (Table 3). American ginseng usually grows under closed forest canopy. Logging activities open the canopy and strongly modify the ecological parameters of a site (Nault, *et al.*, 1998). After the canopy is opened, light intensity increases, soil moisture declines, daily temperature fluctuations of the forest floor are higher, invasive species are introduced, and competition from tree seedlings, shrubs and herbs increases dramatically. Large individuals that survive such major habitat disturbances, also face intense grazing and seed predation by deer who are attracted by the vigourous forest floor regrowth (pers. observ.). In the eastern Ontario and Quebec portion of ginseng's range, there was a severe ice storm in January of 1998 that caused major damage to the forest canopy. The canopy loss in many ginseng colonies is comparable to heavy selective logging (pers. observ., 1998) and this storm may have a lasting negative impact on a number of colonies.

Ginseng cultivation is a very lucrative industry in Canada. In 1995, the export market value was estimated at $65 million (Clark and Kort, 1996). Canada is presently the fourth ginseng producer in the world (N. Charest, AgCan, pers. comm., 1998). In Ontario, from 1991 to 1995, cultivated ginseng areas increased 250%, from 1564 to 5500 acres (Clark and Kort, 1996). This increase in production has reduced the price paid for field-cultivated ginseng root. The price for wild ginseng root, however, remains high. As a result, there has been an increased interest in woodland-cultivation of ginseng that may represent a major threat for wild ginseng. The habitat disturbances associated with site preparation (understorey clearing) and maintenance (i.e. uses of fertilizers and fungicides), the introduction of seed-borne pathogens that are common in commercial seeds, and the introduction of foreign genes by planting seeds from unknown sources can have a significant impact on wild populations (Nault, 1998). Woods-grown ginseng plantations presently cover from 1,000 to 2,000 acres in Ontario (Jan Schooley, OMAFRA, pers. comm., 1998). In Quebec, where this industry started only a few years ago, ginseng plantations already occupy about 100 acres (Isabelle Nadeau, CLDE, pers. comm., 1998). Considering the constant habitat loss and degradation of mature forests due to logging, forest management and development, additional habitat loss and degradation due to ginseng cultivation is critical.

EVALUATION AND PROPOSED STATUS

Ginseng was designated as a threatened species in 1988 on the basis of continuing habitat loss, the small size of most populations, and, most importantly, the continuing overharvest of the plant for medicinal use. Before 1988, much wild ginseng was being harvested in Ontario and exported to Asia, however, shortly after the status report was written, exporting wild ginseng was no longer permitted. Harvesting ginseng for domestic sale was unaffected and the root is still widely available in natural food stores (Wilkins 1998). The continuing reduction and eradication of populations due to harvest suggest that closing the export market for wild ginseng has had little impact on ginseng conservation.

There is 139 records for American ginseng in Canada, 65 in Ontario and 74 in Quebec. Among those, 42 Ontario sites were surveyed from 1996 to 1998; 31 populations are extant and 11 extirpated. In Quebec, among the 59 sites studied in detail from 1994 to 1998, 49 are extant and 10 are extirpated. The status of the species, both in Ontario and Quebec, is very precarious. Extirpation rates in the last five to ten years are high (i.e. Ontario: 27%; Quebec: 17%). The distribution range in Quebec is reduced by more than 100 km at its north-eastern limit. Most populations surveyed in Ontario between 1988 and 1997 have been extirpated or are declining. Only seven viable populations are known in Ontario, and 15 in Quebec, but none of them is secure. In Ontario, harvesting between 1988 and 1997 was confirmed or suspected in 55% of the sites visited (9 were lost) and logging was suspected of causing declines in 25% of the colonies. Clearly, harvest and habitat loss and degradation since the 1988 status report have significantly reduced the ginseng population in Canada. Moreover, the potential threat from the quickly-developing woods-grown ginseng industry could have a major impact on the species survival. If this trend is not quickly reversed, ginseng could disappear from much of its Canadian range. Thus, it is recommended that the status designation of threatened be changed to endangered.

The very precarious situation of ginseng in Canada demands concrete actions to promote its survival. We make the following recommendations :

1) Conduct additional field surveys in Ontario to document populations in under-represented areas.
2) Establish a monitoring program in protected areas.
3) Develop a preventive approach to protect all viable populations.
4) Promote restoration of small populations to avoid further extinctions.
5) Conduct an impact-assessment study of the effects of wood-cultivation on the ginseng habitat.
6) Apply phytosanitary control for commercial seeds.
7) Legislate an outright ban on the domestic sale of wild ginseng root.
8) Re-evaluate the species' status within three to five years.

PROTECTION

Since the designation of ginseng as a threatened species, few steps have been taken to enhance the species' chances of survival in Canada. Since ginseng is listed under Appendix II of CITES, the Ontario government was required to monitor the species to ensure that it did not become endangered due to overharvest for international trade. Shortly after the COSEWIC designation of threatened status was made, export permits were no longer issued for Ontario-dug wild ginseng. Surprisingly, U.S. Customs data shows that the United States imported 6,000 kg of wild ginseng roots from Canada in 1996 (Robbins, 1998). Two possibilities are suggested to explain the situation : 1) misreporting cultivated ginseng for wild ginseng and 2) Canada exporters using the term "woods-grown" on shipping manifests that is interpreted and reported as wild ginseng by U.S. Customs. Some wild ginseng has been seized during the inspection of materials submitted for export permit to CITES. A single shipment of 16 pounds of dry roots was confiscated in 1997 (Coote, 1998). Lack of resources to verify each parcel submitted to CITES for permit delivery can result in the illegal export of wild ginseng along with cultivated roots. High quality wild roots are suspected of being exported from Canada to Asia in small quantities in personal luggage (Coote, 1998). In the United States, the exportation of wild ginseng increased dramatically from 1990 to 1996, from 67 to 190 metric tons (Robbins, 1998). It is not known how much of this vast quantity is truly wild root and how much is woods-grown.

Several populations of ginseng occur in provincial parks or other "protected areas". In Ontario, trails near at least two populations in protected areas have been relocated in order that the ginseng remain "out of sight". One trail relocation occurred after a partial harvest. In the second case, only a minor change was made to the trail; the large population nearby was harvested a few years later. Another large colony in a soon-to-be-developed private woodlot in eastern Ontario was relocated to a protected area in 1991 (by DJW).

In Quebec, a conservation project for ginseng was initiated in 1994 at the Biodome of Montreal, to 1) characterize ginseng populations and their habitat; 2) develop micropropagation techniques for restoration purposes and 3) restore 10 depauperate populations (Nault, *et al.*, 1997). In 1997, a monitoring program was established in 10 key sites through the province and restoration efforts were maintained. Collaboration is also taking place with ginseng producers in the province (via the Centre local de développement de l'érable, Plessisville). They are informed of the species status in the wild, and of the possible impact of wood cultivation on wild colonies. Ginseng should soon be designated a "threatened" species in Quebec, under the Endangered Species Act (bill 108) (Nault, 1997).

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LITERATURE CITED

Charron, D. 1989. La dynamique des populations de ginseng (*Panax quinquefolium* L.) dans le sud du Québec. M.Sc. Thesis, Université du Québec à Montréal, Montréal. 110 pp.

Charron, D. and D. Gagnon. 1991. The demography of northern populations of *Panax quinquefolium* (American ginseng). Journal of Ecology 79: 431-445.

Clark, H. and J. Kort. 1996. Ginseng update. Saskatchewan Irrigation Development Centre, Market News 4(2): 1-9.

Coote, L. 1998. Ginseng Conservation Issues, meeting held by the WWF, September, 14th, Toronto.

Gagnon, D. and D. Charron. 1987. Report on the status of *Panax quinquefolium* in Quebec. Unpublished report prepared for World Wildlife Fund, Canada. 8 pp. + Appendices.

Lewis, W.H. and V.E. Zenger. 1982. Population dynamics of the American ginseng *Panax quinquefolium* (Araliaceae). American Journal of Botany 69: 1483-1490.

Menges, E. 1992. Stochastic modeling of extinction in plant populations. In *Conservation biology: the theory and practice of nature conservation, preservation and management*, ed. P.L. Fiedler and S.K. Jain, p. 253-275. Chapman and Hall, New York.

Nantel, P., D. Gagnon and A. Nault. 1996. Population viability analysis of American ginseng and wild leek harvested in stochastic environments. Conservation Biology 10: 608-620.

Nault, A. 1998. La culture du ginseng au Québec : une menace pour les populations indigènes? Naturaliste canadien été 1998: 8-12.

Nault, A. 1997. La situation du ginseng à cinq folioles (*Panax quinquefolius* L.) au Québec. Gouvernement du Québec, ministère de l'Environnement et de la Faune, Direction de la conservation et du patrimoine écologique, Québec. 43 pp.

Nault, A., D. Gagnon, D. White, and G. Argus. 1998. Conservation of ginseng in Ontario. Report 1997/1998. Ministry of Natural Resources, Science and Technology - East Science Unit. Unpublished report. 89 pp.

Nault, A., S. Laliberté and C. Leclerc-Potvin. 1997. Conservation et restauration de l'ail des bois et du ginseng - Final report. Gouvernement du Québec, ministère de l'Environnement et de la Faune, Direction de la recherche, Québec. Unpublished report. 79 pp.

Robbins, C. S. 1998. American ginseng: the root of North America's medicinal herb trade. TRAFFIC North America, Washington, U.S.A. 94 pp.

Sutter, R. D. 1982. The ginseng monitoring program in North Carolina. In *Proceedings of the 4th national ginseng conference*, p. 117-122, Lexington, Kentucky.

White, D. J. 1988. Ecological study and status report on American Ginseng *Panax quinquefolium* L. A threatened species in Canada. Committee on the Status of Endangered Wildlife in Canada. Canadian Wildlife Service, Ottawa. Unpublished report. 170 pp.

White, D.J. 1988. COSEWIC status report on American ginseng *Panax quinquefolium* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. 170 p.

Wilkins, H. 1998. A report on the harvest and availability of Ontario wild ginseng. WWF, Toronto. Unpublished report. 13 pp.

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